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(54) **Weldable vapor vent valve for fuel tanks**

Schweissbares Entlüftungsventil für Kraftstofftanks

Soupape d'évacuation de vapeurs pour réservoir de carburant

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(56) References cited:
US-A- 5 139 043
US-A- 5 313 977
US-A- 5 404 907
US-A- 5 666 989

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Description

Field of the Invention

[0001] The present inv ntion is in the field of vent valves capable of being welded to polymeric fuel tanks, and more specifically relates to weldable vapor vent valves of the type having two joined portions formed from dissimilar materials, one of which is weldable to the fuel tank, the other of which is heat- and vapor-resistant in accordance with the preamble of claim 1.

Background of the Invention

[0002] Automotive manufacturers are increasingly forming automotive fuel tanks from polymeric materials (hereafter "plastics"), for example polyethylene, to take advantage of efficient manufacturing processes such as blow molding. Vapor venting valves are typically needed in or on the tank to vent fuel vapor from the tank. Properly sealing such valves to prevent fuel and fuel vapor from leaking to the surroundings is always an important consideration.

[0003] Valves used with plastic fuel tanks are preferably welded to the tank, for example using hot-plate welding techniques where the mating tank and valve surfaces are heated and brought into contact under a compressive force until the surfaces bond. There are two major problems associated with welding valves to the tank. First, the materials which lend themselves to being welded to plastic fuel tanks, i.e. materials similar to those used in the fuel tanks, are often not suitable for making quality vent valves because they are too soft, subject to long term creep problems, and susceptible to damage from the heat in the welding process. However, harder, higher-melting temperature plastic materials such as nylon which are suitable for use in the valve body are difficult if not impossible to weld to the plastic used for the fuel tanks. For example, polyethylene and nylon simply do not weld very well due to their different melting temperatures and other properties.

[0004] US-A-5,404,907 issued to Benjey et al. illustrates one solution to the above problems by providing an efficient connection and sealing arrangement between a weldable connector portion and a non-weldable valve body.

[0005] In a first embodiment of US-A-5,404,907, a standard, non-weldable vent valve includes a main valve body having a lower portion for insertion through an aperture in the fuel tank wall to extend into the fuel tank, and an upper portion positioned above the fuel tank when the valve is inserted. A weldable connector is connected to the upper portion of the valve body so that at least a portion of the weldable connector is in position for welding to the fuel tank when the vent valve is positioned in the fuel tank aperture. The weldable connector is overmolded onto the upper portion of the valve body. The valve body includes a plurality of circumferential, horizontal anti-leak ribs on its exterior. The ribs enhance the connection between the overmolded weldable connector portion and the upper portion of the valv body, and further provide a circuitous, labyrinth-type flow-restricting interface between the weldable connector and the valve body to pr vent leakage of fuel and vapor between them.

[0006] Referring to Figure 1 of US-A-5,404,907, a heat-resistant vent valve body 20 has a lower portion 22 inserted through aperture 11 in fuel tank wall 10. An upper portion 24 of the valve body extends above fuel tank wall 10 and includes horizontal anti-leak ribs 34. A weldable connector 38 is overmolded on valve body 20, flowing around and between ribs 34 during the molding process to create a strong connection between them. Ribs 34 also provide a labyrinth type flow-restricting interface seal between valve body 20 and weldable connector 38 to prevent liquid fuel and fuel vapor leakage. Weldable connector 38 is welded to fuel tank wall 10 with weld feet 42 of known type.

[0007] The embodiment of Fig. 3 corresponds to the preamble of claim 1.

Summary of the Invention

[0008] In general the present invention is considered an improvement over the structure of Fig. 3 of U.S. Patent No. 5,404,907, in that the push-fit connection between the weldable connector and the valve body prior to welding to the fuel tank involves sets of vertical, interlocking ribs. In a preferred form a mating locking structure apart from the ribs is provided.

[0009] These and other features of the present invention will become apparent upon further reading of the specification in light of the accompanying drawings.

Brief Description of the Illustrated Embodiment

[0010]

Figure 1 is a side section view of a prior art overmolded vent valve and weldable connector structure according to US-A-5,404,907, connected to a fuel tank; and

Figure 2 is a side section view of a vent valve and weldable connector structure according to the present invention, connected to a fuel tank.

Detailed Description of the Invention

[0011] An illustrative example of a preferred form of the invention is shown in Figure 2. A weldable vapor vent valve assembly 118 comprises a heat-resistant main valve body 120 having a lower portion 122 capable of being inserted through an aperture 11 in the fuel tank wall 10, and a weldable connector portion 138 secured to the upper end of the valve body. Fuel tank wall 10 comprises a plastic suitable for blow molding, such as

polyethylene. Valve body 120 can be formed out of any suitable plastic material so long as it is sufficiently heat-resistant to withstand the temperatures achieved during welding and exposure to the fuel vapor laden environment of the tank. In the preferred embodiment valve body 120 is nylon, although other materials can be used. Weldable connector 138 is formed from a material that is weld-compatible with fuel tank wall 10. In the preferred embodiment both the fuel tank and weldable connector 138 are formed from polyethylene, although other possible combinations of weld-compatible materials will be known to those skilled in the art.

[0012] Valve body 120 defines a vent outlet 126, communicating fuel vapor between the hollow interior of lower valve body 122 and a conduit 128 shown extending at right angles from upper portion 124. Conduit 128 may be formed separately and attached to weldable connector 13 8, or may be formed integrally with weldable connector 138 as illustrated in Figure 2.

[0013] The valve structure used in valve body 120 can comprise almost any valve structure known in the art, and is not critical to the present invention. In the illustrated example of Figure 2, the valve structure is a known type of liquid level responsive float mechanism in which a spring-biased float 121 supporting a peelaway type valve element 123 on its upper end is raised against and lowered away from vent outlet 126 to close and open vapor flow as liquid fuel level in the tank rises and falls. By way of example only, valve structure of the type illustrated at 121 in Figure 2 is described in greater detail in US-A-5,313,977. Other types of liquid level responsive valve structures can be used with the weldable vent valve assembly of the present invention for different purposes not addressed herein, including but not limited to onboard refueling vapor recovery, rollover shutoff functions, and fill control functions.

[0014] Weldable connector 138 and valve body 120 are assembled and sealed against liquid and vapor leaks by interlocking sets of vertical ribs 134, 135 formed on the upper end of valve body 120 and the inside surface of connector 138, respectively. Interlocking vertical ribs 134, 135 comprise ring-like flanges of material formed integrally with and extending from the valve body and the weldable connector. It may be possible to attach ribs 134, 135 to the valve body and the weldable connector subsequent to their being molded, but integrally molded ribs are preferred.

[0015] Illustrated ribs 134, 135 are shown as continuous, concentric rings of material extending from the valve body and the weldable connector. In the illustrated embodiment, two weldable ribs 135 are shown inserted into and sandwiched between three valve body ribs 134. It will be understood by those skilled in the art that the total number of ribs 134 and 135 may vary within the scope of the claims depending on the size of the valve assembly, the desired strength of the mechanical connection between the weldable connector and the valve body, and the desired length of the anti-leak labyrinth established between the interlocking ribs. The preferred structure for sealing is to have at least one rib from each of the weldable connector and the valve body sandwiched by two ribs from the other. This will insure sealing even if one material has a greater dimensional change due to thermal or fuel swell effects. The minimum number of upstanding valve body ribs 134 is two, with a matching minimum of one weldable rib 135 so that each weldable rib 135 is trapped between two valve body ribs 134.

[0016] The width or thickness of weldable ribs 135 is preferably slightly greater than the spacing 134a between adjacent valve body ribs 134, thereby creating an interference fit between ribs 135 and ribs 134, in which weldable ribs 135 are deformed to provide a fluid- and vaportight seal with ribs 134.

[0017] It will be understood from Figure 2 that the interlocking, sealing fit between ribs 134 and 135 not only prevents fuel vapor leakage from vent outlet 126 out through the interface of weldable connector 138 and valve body 120 to the surroundings, but further prevents liquid fuel from entering outlet 128 from the fuel tank between the interface of the weldable connector and the valve body.

[0018] It may be desirable in some circumstances to enhance the interlocking, sealing fit between ribs 134 and 135 beyond that achieved by the deformable nature of ribs 135 and the interference fit between them. For example, it may be desirable in some applications to apply an adhesive or other bonding agent to one or both sets of ribs 134, 135 prior to assembling them in a push-fit. It may also be possible in some applications to heat or cool one or both sets of ribs 134, 135 to improve the sealing fit between them. However, the preferred arrangement is a straight-forward interference fit between the ribs as described above.

[0019] While the interlocking fit between ribs 134 and 135 may be sufficient in some circumstances to hold weldable connector 138 and valve body 120 together mechanically, it will typically be desirable to provide additional locking structure between the two components, for example as shown in the illustrated embodiment at 123, 146. In the illustrated embodiment, the sidewall of valve body 120 is provided with beveled tabs 123 which first push aside the ends of a flexible sleeve 146 extending downwardly from weldable connector 138 over and around a portion of valve body 120, and then lock into place in suitably spaced apertures 147. Inserting the valve body 120 into sleeve 146 may be enhanced by beveling regions 145 on the lower end of the sleeve. The relative heights of tabs 123 and apertures 147 is designed to allow for a predetermined axial length of insertion of ribs 135 between ribs 134 before tabs 123 lock into apertures 147 on the sleeve.

[0020] Once weldable connector 138 has been assembled to valve body 120 as described above, in a simple axial push-fit without the need for additional operations such as overmolding, and without the need for any

additional structure beyond that incorporated directly and integrally into the weldable connector and the valve body, the valve assembly can be inserted through aperture 11 in fuel tank wall 10 and welded to the fuel tank with weld feet 142 in known fashion.

[0021] It will be understood by those skilled in the art that the foregoing illustrated example of a preferred embodiment of the invention may be modified by those skilled in the art without departing from the scope of the invention as defined in the following claims. For example, the type of valve body 120 and its internal valve structure 121, 123 can vary, and can comprise almost any known valve structure capable of withstanding weld temperatures. The exact size and shape of the weldable connector can vary, depending on the desired weld attachment to the fuel tank and the types of outlet connections established with outlet structures such as that shown by way of example at 128. The size of vertical interlocking ribs 134, 135 can also vary within the scope of the claims depending on the particular application. Accordingly, the invention claimed is:

Claims

1. A weldable vent valve (118) capable of being welded to a polymeric fuel tank (10), the vent valve (118) comprising:

   a non-weldable main valve body (120), the main valve body (120) having a lower portion (122) adapted to extend into the fuel tank (10) through an aperture (11), and an upper portion (124) adapted to extend above the fuel tank (10), the main valve body (120) defining a vapor flow path (126) from the interior to the exterior of the fuel tank (10);
   a weldable connector (138) assembled to the main valve body (120) in an interlocking, sealing push-fit, the weldable connector (138) comprising a weldable material suitable for welding to the fuel tank (10), at least a portion of the weldable connector (138) designed to be in contact with the fuel tank (10) for welding to the fuel tank (10) when the main valve body (120) is operatively positioned in the fuel tank aperture (11); **characterized by**
   a first number of vertical ribs (135) being formed on a lower surface of the weldable connector (138), and a second number of vertical ribs (134) being formed on an upper end of the valve body (120), the vertical ribs (135, 134) on the weldable connector (138) and the valve body (120) adapted to mate axially in the interlocking, sealing push-fit such that at least one rib (135) from the weldable connector (138) is sandwiched between two ribs (134) from the valve body (120), and at least one rib (134) from the valve body is sandwiched between two ribs (135) from the weldable connector (138).

2. The weldable vent valve (118) of claim 1, further including mating locking structure (123,146) formed on the valve body and the weldable connector apart from the ribs (134, 135), for providing an axial locking connection between the weldable connector (138) and the valve body (120) apart from the ribs (134, 135).

Patentansprüche

1. Verschweißbares Entlüftungsventil (118), das an einen Polymeren-Kraftstofftank (10) anschweißbar ist, wobei das Entlüftungsventil (118) aufweist:

   einen nicht verschweißbaren Hauptventilkörper (120), wobei der Hauptventilkörper (120) ein Unterteil (122), das durch eine Öffnung (11) in den Kraftstofftank (10) ragen kann und ein Oberteil (124) aufweist, das sich oberhalb des Kraftstofftanks (10) erstrecken kann, wobei der Hauptventilkörper (120) einen Strömungsweg (126) für Dämpfe von dem Innenraum zu der Umgebung des Kraftstofftanks (10) begrenzt;

   ein anschweißbares Verbindungsstück (138), das an dem Hauptventilkörper (120) in einem ineinander greifenden, abdichtenden Schiebesitz montiert ist, wobei das anschweißbare Verbindungsstück (138) ein zum Anschweißen an dem Kraftstofftank (10) geeignetes, verschweißbares Material aufweist und wenigsten ein Teil des anschweißbaren Verbindungsstücks (138) so ausgebildet ist, dass es bei betriebsmäßig in die Kraftstofftanköffnung (11) eingesetztem Hauptventilkörper (120) mit dem Kraftstofftank (10) zum Anschweißen an dem Kraftstofftank in Berührung steht, **gekennzeichnet durch**

   eine erste Anzahl vertikaler Rippen (134), die an einer unteren Fläche des anschweißbaren Verbindungsstücks (138) ausgebildet sind und eine zweite Anzahl vertikaler Rippen (134), die an einem oberen Ende des Ventilkörpers (120) ausgebildet sind, wobei die vertikalen Rippen (135,134) an dem anschweißbaren Verbindungsstück (138) und dem Ventilkörper (120) axial in dem ineinander greifenden abdichtenden Schiebesitz ineinander passen, derart, dass wenigstens eine Rippe (135) an dem anschweißbaren Verbindungsstück (138) sandwichartig zwischen zwei Rippen (134) an dem V ntilkörper (120) aufgenommen ist und wenigstens eine Rippe (134) an dem Ventilkörper

sandwichartig zwischen zwei Rippen (135) an dem anschweißbaren Verbindungsstück (138) aufgenommen ist.

2. Verschw ißbares Entlüftungsventil (118) nach Anspruch 1, das außerdem zusammenpassende Verriegelungsmittel (123, 146) aufweist, die außer den Rippen (134,135) an dem Ventilkörper und dem anschweißbaren Verbindungsstück ausgebildet sind, um getrennt von den Rippen (134,135) eine axiale Verriegelungsverbindung zwischen dem anschweißbaren Verbindungsstück (138) und dem Ventilkörper (120) herzustellen.

Revendications

1. Electrovalve de mise à l'air libre soudable (118) pouvant être soudée à un réservoir de carburant polymérique (10), cette électrovalve de mise à l'air libre (118) comprenant :

un corps principal d'électrovalve non-soudable (120), le corps principal de valve (120) ayant une partie inférieure (122) adaptée pour s'étendre dans le réservoir de carburant (10) à travers une ouverture (11) et une partie supérieure (124) adaptée pour s'étendre au-dessus du réervoir de carburant (10), le corps principal d'électrovalve (120) définissant une voie de passage de vapeur (126) depuis l'intérieur vers l'extérieur du réservoir de carburant (10) ;
un connecteur soudable (138) assemblé au corps d'électrovalve principal (120) dans un ajustement correct d'étanchéité de verrouillage ; le connecteur soudable (138) étant constitué d'un matériau soudable approprié pour la soudure du réservoir de carburant (10), une partie au moins du connecteur soudable (138) conçue pour être en contact avec le réservoir de carburant (10) pour souder le réservoir de carburant (10) lorsque le corps principal d'électrovalve (120) est positionné en fonctionnement dans l'ouverture du réservoir de carburant (11) ; **caractérisé par** :

un premier nombre de nervures verticales (135) étant formées sur une surface inférieure du connecteur soudable (138), et un second nombre de nervures verticales (134) étant formé sur une extrémité supérieure du corps d'électrovalve (120), les nervures verticales (135,134) sur le connecteur soudable (138) et le corps d'électrovalve (120) adaptées pour s'ajuster axialement au verrouillage, scellant l'ajustement correct de sorte qu'au moins une nervure (135) du connecteur soudable (138) est intercalée entre deux nervures (134) du corps principal (120) et au moins une nervure (134) du corps d'électrovalv est intercalée entre deux nervures (135) du conn cteur soudable (138).

2. Electrovalve de mise à l'air libre soudable (118) selon la revendication 1 comprenant en outre une structure de verrouillage correspondante (123.146) formée sur le corps d'électrovalve et le connecteur soudable séparée des nervures (134.135) pour fournir une connexion de verrouillage axiale entre le connecteur soudable (138) et le corps d'électrovalve (120) séparée des nervures (134, 135).

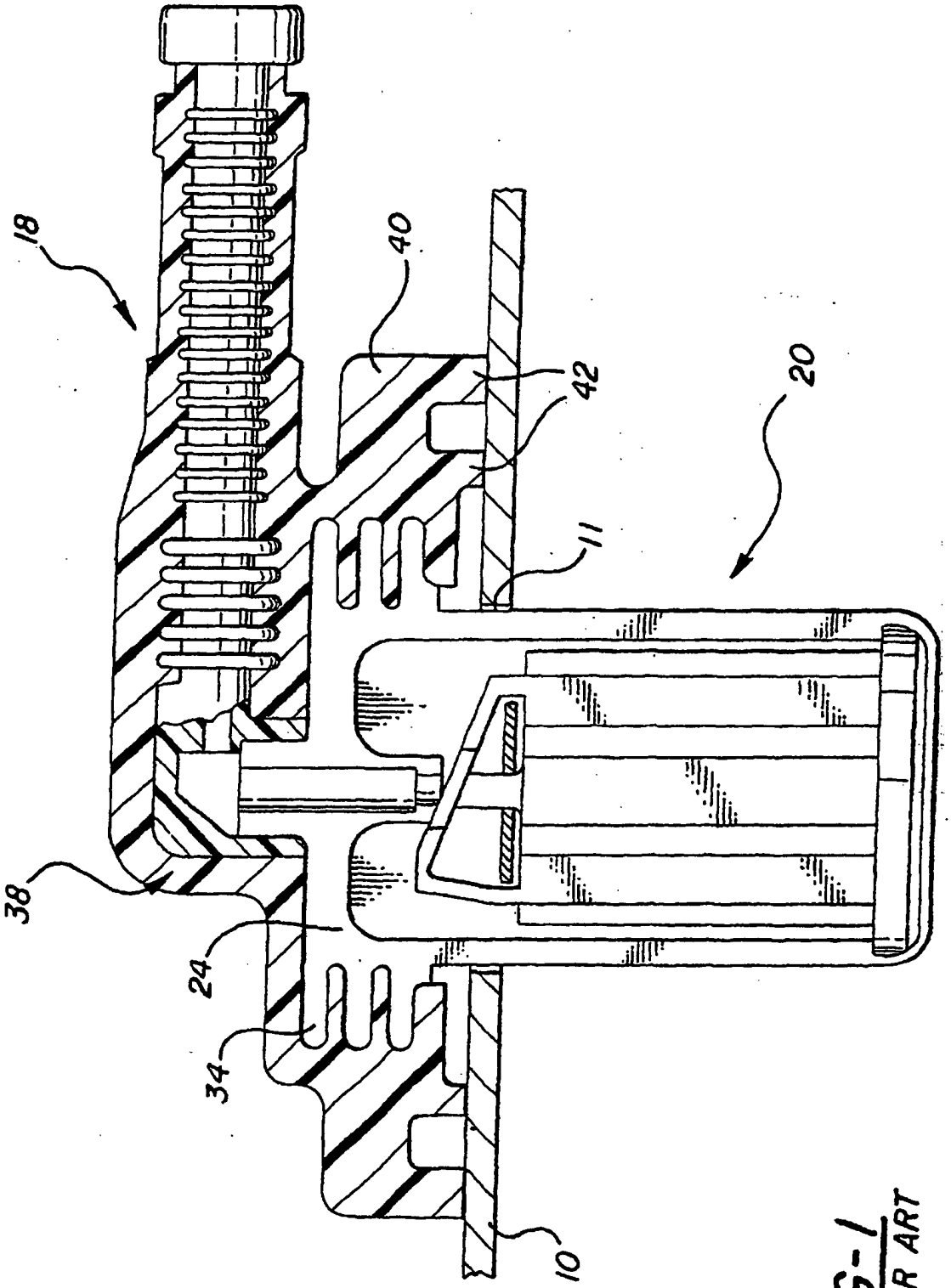

FIG-1
PRIOR ART

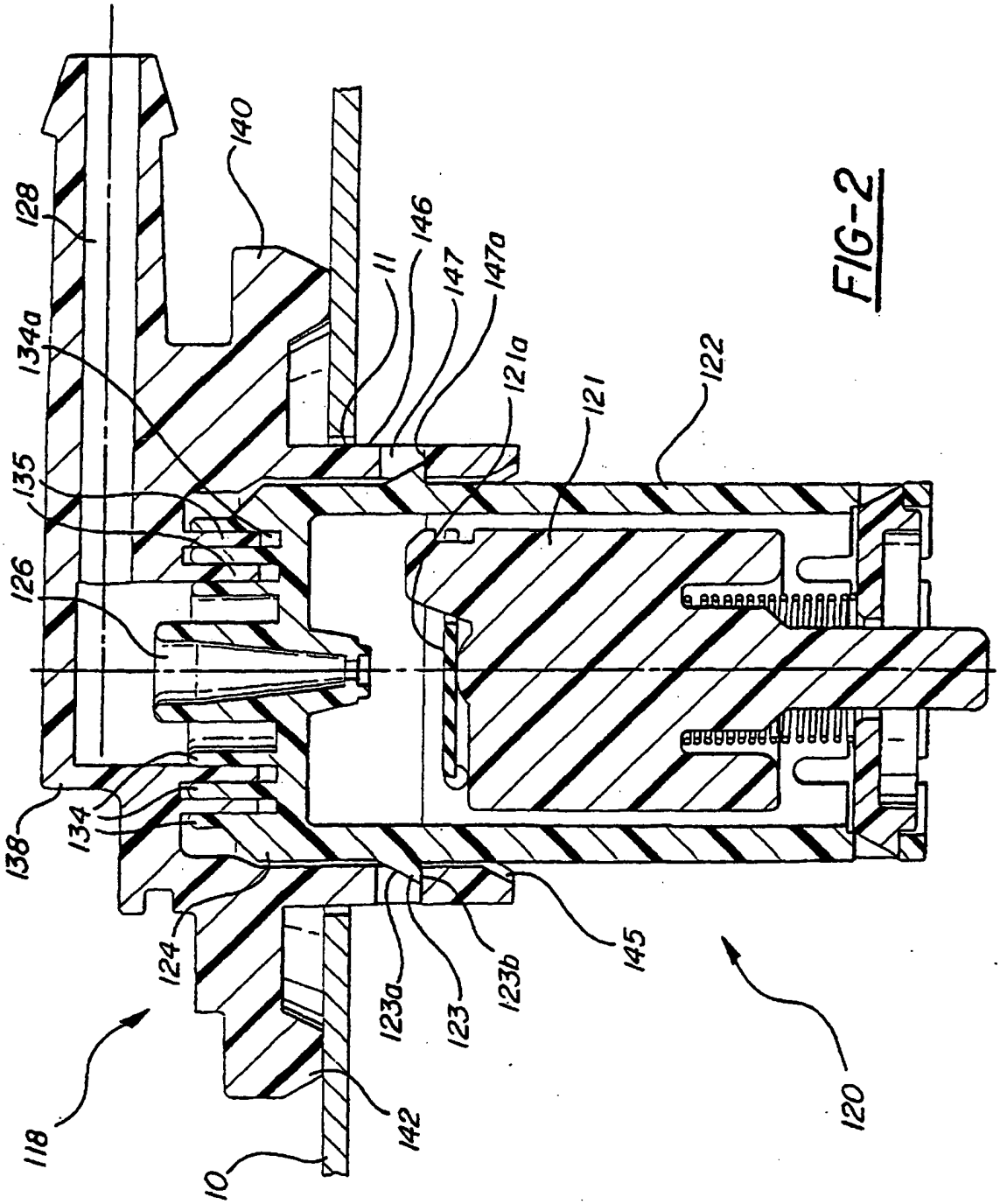
128
140
146
11
147
147a
134a
121a
121
122
135
126
138
134
124
123a
123
123b
145
118
142
10
120

FIG-2